ACPA-AM2V
Analysis of Control Problem with Applications ACT1106
Analysis and Mathematical Modeling Valparaíso
Departamento de Matemática, Universidad Técnica Federico Santa María
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Postdoctoral research position

A one-year postdoctoral research position is available at the Group *Analysis and Mathematical Modeling Valparaíso* in the Departamento de Matemática at Universidad Técnica Federico Santa María. This position is funded by Anillo Project ACT1106 Analysis of Control Problem with Applications - ACPA.

The Group is looking for a candidate holding a doctoral degree in applied mathematics, specialized in one of the following (or related) areas:

- Control of Partial differential equations and Inverse problems;
- Optimization and variational analysis;
- Numerical Analysis for optimization and control problems.

The candidate's research record should include publications in international journals. A knowledge of Spanish is not required. The candidate is expected to contribute with the research project with innovative ideas and publish in high-quality journals. We offer a creative and social work environment, good opportunities for scientific development, no teaching load and competitive gross salary[1] (US$ 2.500 app. per month before taxes). Financial support for at least one travel related to the scientific project each year, is also available. Further information about the AM2V's research and the Anillo Project can be found at www.am2v.cl

The expected starting date is March, 2015. Proposals for a shorter stay than one year can also be considered.

Applications should submit a Curriculum Vitae, copies of the most relevant publications, a short scientific project related with the aims of the ACT1106 project (see Project Summary below), and at least one recommendation letter before **January 15, 2015**, to: am2v@usm.cl.

For further information, please contact am2v@usm.cl

[1] As a reference, the rent of a furnished apartment nearby the University campus is about US$ 700 per month.

PROJECT SUMMARY

ANILLO ACT110

Analysis of Control Problem with Applications - ACPA

Control Theory and related areas of mathematical analysis constitute extremely active fields of modern mathematics research. These fields involve both profound theoretical challenges and applications in domains as diverse as biology, environmental sciences, engineering, and others.

This proposal is concerned with the search for new and innovative mathematical tools and knowledge to analyze problems that originate in real-world activities. In modern mathematics, these advances are often achieved by combining techniques and ideas from two or more distinct areas of research. In this project, we plan to use our background in applied mathematics to analyze specific problems, using interdisciplinary approaches: Optimization, Numerical Analysis, Inverse Problems, Control of Partial Differential Equations, Mathematical Programming, and Optimal Control.

The main general objective of this proposal is to consolidate the scientific work of the researchers participating in this project to establish the first research group in Chile focusing on theoretical control and optimization problems. This group will become an important scientific center in our country, where the mathematical community currently comprises approximately 170 researchers. Funding of this proposal should have a significant impact on our small community.

The members of this project have a strong foundation in applied mathematics, modeling, and related fields. This background will contribute to a multidisciplinary approach to identify solutions to applied mathematics problems. To fulfill the main objective of this proposal, we present the Scientific Objectives that constitute the core of the scientific research proposed in this project.

SO1. *Control of bioprocesses.* In classical macroscopic models of bioprocesses, the biomass is viewed as a catalyst for the conversion of substrates into products. One key issue is the optimization of the production of the synthesis product or biomass. We will address the issue of optimizing bioreactors using both approaches, optimal control and adaptive control.

SO2. *Sustainable exploitation of marine resources.* Important fisheries are currently in a precarious situation. Mathematical modeling can provide new and rigorous perspectives that can contribute to solutions. The models considered by regulatory organisms are non-linear and age-structured, and they should be supported by experimental observations. We plan to develop new theoretical tools in an effort to apply optimization and control techniques to realistic models.

SO3. *Signal compression and recovery.* The quality of signals depends on their storage and transmission, which usually involves two major transformation steps: codification and reconstruction. Each of the two steps can be considered an optimization problem. We plan to address this problem by applying constrained optimization algorithms to the original infinite-dimensional signal spaces.

SO4. *Control and inverse problems for Partial Differential Equations (PDEs).* We primarily address controllability, stabilization, and single-measurement inverse problems of PDEs. We will study the parameter-identification problems of PDEs in relation to two kinds of mathematical models: those related to bioprocesses and fluid/solid problems in biomechanics.

SO5. *Numerical analysis of control problems.* We intend to combine the expertise of the researchers concerning the control theory with numerical techniques to develop discrete controls that converge to continuous controls. Furthermore, we intend to develop new strategies that allow us to study analytical and numerical methods for control problems to obtain convergence and optimal convergence rates in both open-loop and closed-loop cases.

SO6. *Inverse problems in earth sciences.* In asymptotic wind models, the necessary wind data is only known by measurements at certain points. We plan to study the optimal control problem of identifying the closest solution of the asymptotic model to these data. Another issue is the inverse problem of recovering the thickness of the plate from partial bathymetric measures, which has been widely studied. We plan to consider this inverse problem from both theoretical and numerical perspectives.

The scientific objectives mentioned below are oriented entirely toward the development of mathematical theory in an interdisciplinary framework.